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Increase in Probability of the Tsunami Formation Correct Forecast

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Abstract

The presented paper exhibits theory of the "gravitational" wave propagation near the Earth surface and in the ocean. There was determined an expression "gravitational" wave which was registered by the gravimeters being placed in several points of the Earth globe. Alteration of gravitational field was accompanied by alteration of the "gravitational" wave which has the velocity differing from the velocity of seismic waves. The theoretical model was proved by many experiments realized under registration of the underwater earthquake core by tens of gravimeters being placed in the Earth globe different points. The "gravitational" waves assist to increase the right forecast probability of the beginning tsunami to 50 %.

Keywords: "gravitational" waves,forecast probability,tsunami;Introduction

1. The Foundation of the Mathematics Model

Under research of the Earth physical fields there are being applied widely seismo-coustic and gravitational measurements. Gravimetric sampling data were significantly weaker on their informational value, than seismo-coustic ones, because generally, the velocity in gravitational waves near the Earth is unknown[1].

In congruence with the common Einstein theory of relativity the propagation velocity of gravitational

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waves that have transverse structure is not higher than velocity of light in vacuum. But later many followed scientific reports proved that the velocity of gravitational waves was equal to the velocity of light in vacuum. A row of our works [2,3,4,5] demonstrated that velocity of "gravitational waves" in the vicinity of the Earth surface was significantly less than the velocity of light in vacuum.

2. The Foundation of the Mathematics Model

Let's consider the earth gravitational field perturbation under the accelerated movement of mass in earthquake core. Let's suppose that electromagnetic force renders relatively weak influence to the gravitational mass in core. Beyond it, we shall linearize model [2], to presume gravitational and elastic forces action onto the core being in-dependent one from another. Such approximation is being used in acoustic tasks decision. Contrary to acoustic problems, let's consider only gravitational forcing separately $F_{add}=F_{gr}$ which acts to the element of core with density ρ_{gr}. Evidently $\rho_{gr}=\rho_{in}$, which means that the densities of inertial mass min and gravitational mass mgr are equal identically. In this case a linear approximation gives the next formal model of the field of accelerated moving mass(AMM):

$$\rho_{\Sigma}\frac{\partial^2\Phi_j}{\partial t^2}+(\lambda_{\Sigma}+\mu_{\Sigma})\frac{\partial\Phi_{ii}}{\partial x_j}+\mu_{\Sigma}\frac{\partial^2\Phi_{ji}}{\partial x_i^2}=F_{add} \tag{1}$$

Where $\Phi_{ii}=\delta_{ij}\Phi_{ij}$-components of field distortion tensor of AMM in the gravitational field of elastic medium in the vicinity of the Earth surface.

$$\Phi_{ii}=(\frac{\partial\ \Phi_1}{\partial x_1}+\frac{\partial\Phi_2}{\partial x_2}+\frac{\partial\ \Phi_3}{\partial x_3}) \tag{2}$$

Divergence of shift $\lambda_{\Sigma}=\lambda+\lambda_{gr}$, $\mu_{\Sigma}=\mu+\mu_{gr}$, λ , μ - coefficients of Lyame characterizing elastic properties of medium. λ_{gr} , μ_{gr}- introduced as quasi- elastic constants characterizing elastic properties of physical vacuum around AMM; $\rho_{\Sigma}=\rho_{in}=\rho_{gr}$ - entire summarized density, numerically being equal to the density of inertial or gravitational mass.

$$\delta_{ij}=\begin{cases}1 & at \quad i=1\\ 0 & at \quad i\neq 1\end{cases} \tag{3}$$

Equation (1) shows, that if AMM is surrounded by vacuum (in this case elastic constants of Lyame $\lambda=0$, $\mu=0$), then the field Φ_i around the mass also can change in space and time. At the same time propagation velocity of gravitation impulse in vacuum would be identified by quasi- elastic constants of gravitational field. λ_{gr} , μ_{gr} as well as by density of medium where the propagation of impulse perturbation of generated gravitational wave occurs.

$$\tilde{N}_{gr}=\sqrt{\frac{F(\lambda_{gr},\mu_{gr})}{\rho_{gr}}} \tag{4}$$

Where $F(\lambda , \mu_{gr})$ combination of quasi- elastic constants characterizing field of gravitation of moving body mass. In common case the velocity of gravitational wave depends on space coordinates and

proportion between elastic constants and density of medium. However, near the Earth surface it could be written as the next:

$$\tilde{N}_{gr}(r) = (\sqrt{\alpha r})^{-1} \tag{5}$$

Where α - constant, that possesses dimension of acceleration of the moving body mass m/sec^2, r - distance in meters. In linear approximation for such dependence C_{gr} equation (1) will be written as the next:

$$\Delta\Phi - \frac{1}{\alpha r}\frac{\partial^2\Phi}{\partial t^2} = F_{add} \tag{6}$$

Where Δ - laplacian, Φ - field potential, connected with tensor of deformation of AMM field under λ=μ=0 .Fundamental factor is that the potential alteration of the gravitational field in space and time experimentally could be revealed by different receivers of gravitational fields.

Fig.2 demonstrates typical graphs of the gravimeter sharp perturbations from earthquakes on the background of smooth indications changes that were produced by tidal waves.

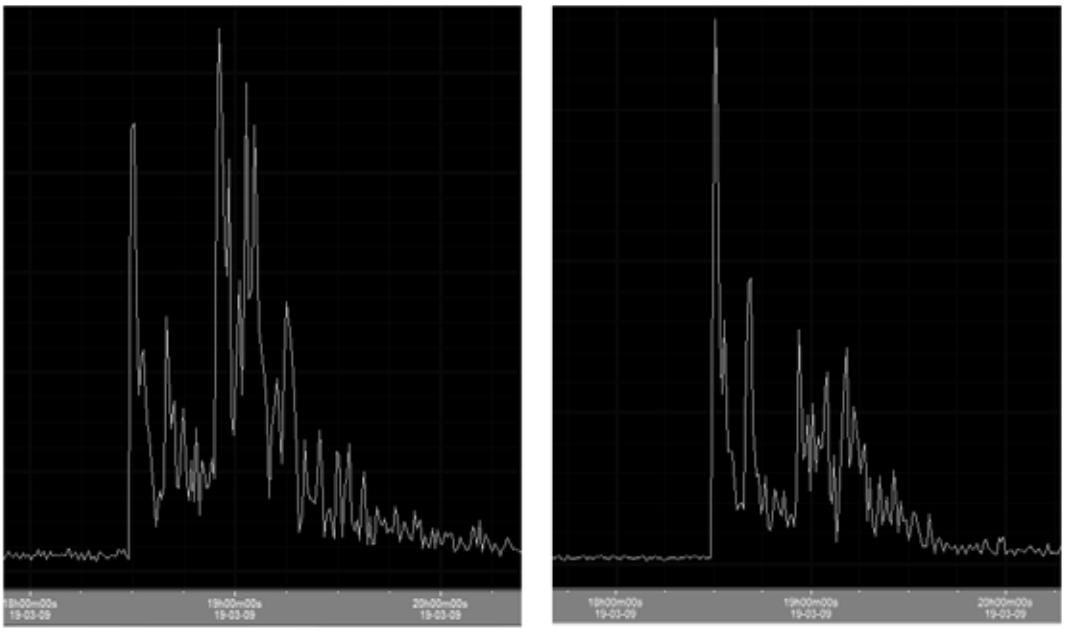

Fig. 1. Signals in point 1 - etropavlovsk-Kamchatsky city and in point 2 - Klyuchi village

Experimental estimations of the propagation velocity of gravitational perturbations ("gravitational waves") near the Earth surface were realized by two gravimeters placed at the distance of r=(700±5)x10^3 meters one from another. The first point of measurement was in Petropavlovsk-Kamchatsky city (1) and second was in Klyuchi village (Kamchatka) (2). Indicators of gravimeters fixed the alteration of value

indications in gravitation and time of these alterations starts to a second. A source of the gravitational field perturbations became the earthquake at 33 km depth, presumably on Fiji (island Tonga). Green-wich time t=02 o'clock 10 minutes 36.6 sec., at 22,89S latitude; 174,97E-longitude and 5,2 magnitude. Difference in time of arrival of three perturbations of weak intensity to the points (1) and (2) was equal to Δt_1=25′ 30″, Δt_2=24′ 15″, Δt_3=23′ 20″ .Basing on such estimations, the velocity of "gravitational" waves would be calculated as $\upsilon^1_{gr} \approx 480 \pm 20$m/sec. The velocity of waves arrival from Tonga island (distance to Petropavlovsk-Kamchatsky is 8802km) will be $\upsilon 2gr \approx 610 \pm 50$ m/sec.

It is clear that these velocities are less significant than the velocity of electromagnetic waves. Theoretically in a row of our previous works, concerning description of "gravitational" waves, there had been already given the same evaluations of velocity and their dependence on distance. However, for detailed research of the velocity dependence on height above earth, continuation would be needed for the exploration with one, two or a few gravimeters.

Experimental research was fulfilled jointly with the group of scientists of IVC Institute of FEB RAS under the leadership of Professor Seliverstov N.I. and scientist Abkadyrov I. from Petropavlovsk-Kamchatsky city having applied gravimeters of AVTOGRAV-TMCq-5 type, grade of accuracy №1.

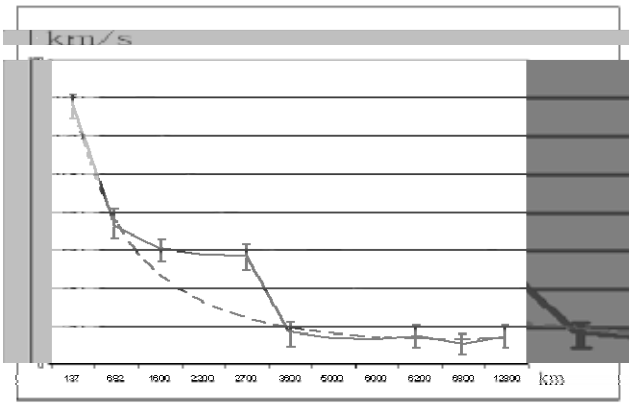

Fig.2. Theoretical dependence [---] and experimental curve. Picture shows dependence of “gravitational” waves velocity on distance between receivers

3. Results

Due to description of alteration in the gravitational field potential by wave equation and velocity of perturbation ++ movement is similar to the velocity of tsunami propagation in water, then, there was supposed the next: evidently, a tsunami was generated in such case, when the core of earthquake was moving with negative acceleration. The height of water upheaval in the core of earthquake depends only on the potential of disturbed gravitational field and doesn't depend on mechanical properties of water. In this case liquid serves as the indicator of gravitational field intensity and speed of tsunami run through space was determined by the velocity of gravitational propagating perturbation. The gravitational field perturbations could be fixed not only by an under-water receiver but applying other receivers located above the water surface (gravimeter, devices for pressure measurement).

Nature of origin of another phenomenon, such as cy-clone, tornado, typhoon, might not be explained only by temperature drops and atmospheric pressure changes. The atmospheric pressure changes, evidently, are linked with alteration in the Earth gravitational field. Temperature is the secondary factor

what supports the process. Having estimated the velocity of "gravitational" propagating perturbation, the navigational task on determination of coordinates of the earthquake core could be decided when measuring Φ_{grji} in three (or more) points near the Earth surface. So, under joint consideration of wave properties of elastic, electromagnetic and "gravitational" waves the efficiency of complex measurements for prognoses of natural disasters occurrence in the ocean and coastal zone could be raised.

4. Conclusions

The expounded in the paper research proved unbiased real existence of waves which are being usually emitted by the accelerated moving mass. If this Earth mass lies in the underwater earthquake core, then, it (core) is emitter of gravitational" waves (fig.1). These waves are precisely registered by the standard gravimeters placed in the Earth globe various points. Propagation velocity depends on the location distance between two gravimeters (fig.2). During 2009-2010 years study it was experimentally estimated that only the underwater earthquake generates gravitational" wave what is registered by gravimeters. Having measured the time of signal arrival from the accelerated moving mass by three or more gravimeters, it is possible to decide a navigational task concerning precise determination of the underwater earthquake core coordinates. The gravimeters can be placed in every point of the earth globe, however, the most desirable location place is in the tsunami originating areas.

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